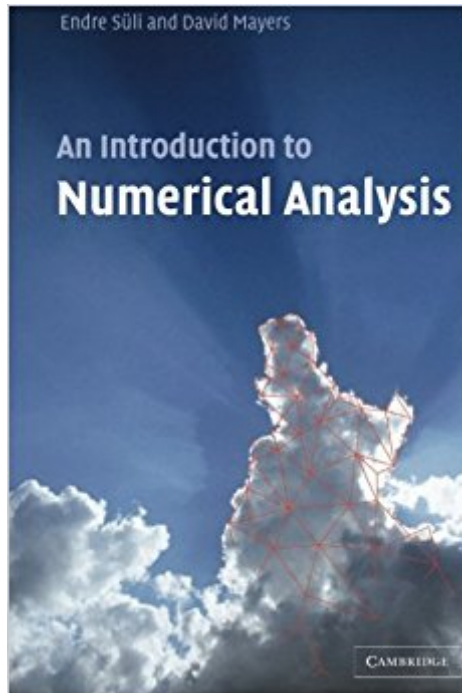




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# An Introduction To Numerical Analysis



## Synopsis

This textbook is written primarily for undergraduate mathematicians and also appeals to students working at an advanced level in other disciplines. The text begins with a clear motivation for the study of numerical analysis based on real-world problems. The authors then develop the necessary machinery including iteration, interpolation, boundary-value problems and finite elements. Throughout, the authors keep an eye on the analytical basis for the work and add historical notes on the development of the subject. There are numerous exercises for students.

## Book Information

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## Customer Reviews

"This book is a solid text in the basics of numerical mathematics, using more of a theoretical background than most. If you are looking for a book to use in a course in numerical analysis where there is an emphasis on the theoretical background, then this one will serve your needs." *Journal of Recreational Mathematics* "carefully written with a good level of rigor" *SIAM Review*

This textbook is written primarily for undergraduate mathematicians but it will also appeal to students working at an advanced level in other disciplines. The text begins with a clear motivation for the study of numerical analysis based on real world problems. The authors then develop the necessary machinery including iteration, interpolation, boundary value problems and finite elements. Throughout, the authors keep an eye on the analytical basis for the work and add interest with historical notes on the development of the subject. There are numerous exercises for students.

This is an excellent resource to brush up on your undergraduate numerical analysis. I've looked at many references, and this one is the best, the clearest, and the most complete. I cannot recommend this textbook highly enough. The reviewer that gave this book a bad review blames his lack of competence on the textbook. These are the most basic topics of numerical analysis, and any decent senior mathematics student should be able to comprehend the material. Real analysis results that are assumed (that usually comprise a basic university calculus courses) are outlined in detail in the appendix.

This book was used for a one semester course in numerical analysis. The companion book was *Numerical Linear Algebra*. Together, these books make an outstanding start to a personal numerical analysis reference shelf. The first half of the book is where pure math students may find trouble since the presentation of linear algebra in math departments varies widely. A practical working knowledge of basic linear algebra is necessary. A poor linear algebra background will require remediation before starting this book. Topics covered in this text that I have found particularly useful over the years include polynomial interpolation and quadrature. The presentation is perfect and easy to understand. Of course, no text can be everything to everyone. It helps to have an enthusiastic and knowledgeable professor leading you through the material. That said, the dedicated student should have no problem navigating this text.

This book has emphasis on analysis of numerical methods, including error bound, consistency, convergence, stability. In most cases, a numerical method is introduced, followed by analysis and proofs. For engineering students, who like to know more algorithms and a little bit of analysis, this book may not be the best choice. Although this book is mainly about analysis, it does include clear presentation of many numerical methods, including topics in nonlinear equations solving, numerical linear algebra, polynomial interpolation and integration, numerical solution of ODE. In numerical linear algebra, it includes LU factorization with pivoting, Gerschgorin's theorem of eigenvalue positions, Calculating eigenvalues by Jacobi plane rotation, Householder tridiagonalization, Sturm sequence property for tridiagonal symmetric matrix. Interpolation includes Lagrange polynomial, Hermite polynomial, Newton-Cotes integration, Improved Trapezium integration through Romberg method, Oscillation theorem for minimax approximation, Chebyshev polynomial, least square polynomial approximation to a known function, Gauss quadrature using Hermite polynomial, Piecewise linear/cubic splines. Ordinary differential equations section includes initial value problems with one-step and multiple steps, boundary value problems using

finite difference and shooting method, Galerkin finite element method. The book gives basic definitions including norms, matrix condition numbers, real symmetric positive definite matrix, Rayleigh quotient, orthogonal polynomials, stiffness, Sobolev space. One place that is not clear is about QR algorithm for tridiagonal matrix. In summary, the book is written clearly. Every numerical method is presented based on mathematics. There are many proofs (there is one proof with more than 3 pages), most of them that I decided to read are pretty easy to follow. There are not much implementation details and tricks. But this book will tell you when a method will converge and when a method is better. As a non-math major reader, I wish it could present more algorithms, such as algorithms for eigenvalues of nonsymmetric matrix, more details in finite difference method, a little bit of partial differential equations etc.

I have read many numerical analysis textbooks and this is, by far, the best. However, if you are looking for a methods text (involving MATLAB, or something similar) you should probably avoid this book. It is an analysis text, and it does a great job covering the basic topics in a first year graduate course.

I had to use this textbook for a first course in Numerical Analysis. It might be one of the worst textbooks I have ever used. It contains a lot of material, but I do not feel it is well suited for a first course in Numerical Analysis at an undergraduate university. The main problem is the textbook assumes too much previous knowledge. I had difficulty understanding even the "simplest" explanations in this textbook because even those were too complicated. I often found myself searching the web and other texts for the concepts that I needed to learn, and I almost always found descriptions that I perfectly understood. Sometimes I could then go back and understand it from this textbook, but only after reading material elsewhere on the subject. Simply put, this textbook might be a decent resource for someone who already knows Numerical Analysis and has a really strong background in Math (I took the class my final semester as part of a BS in Mathematics degree, and my background was not strong enough). However, for "An intro to Numerical Analysis" as this title states, this is NOT the textbook to use.

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